

IN THE CLAIMS:

This listing of the claim will replace all prior versions and listings of claim in the present application.

Listing of Claims

1. (previously presented) A storage system comprising:

a disk controller which has a CPU, a main memory, and an interface;

and

a disk device which has original volumes for backup and a storage pool for backup data,

wherein the main memory incorporates a differential management program which checks whether the original volumes for backup are updated or not, a pool management program which allocates a disk area for storage of backup data to the storage pool for backup data, a performance management program which manages the performance of each volume of the disk device, and a backup control program which issues an instruction to the differential management program, the pool management program, and the performance management program for total backup control,

wherein the backup control program selects a backup method by which recovery within a user-specified recovery object time is possible, according to a restore performance calculated by the performance management program and the total size of changed blocks after backup acquisition as counted by the differential management program,

wherein the performance management program maintains a performance management table which is used to manage disk and volume performance and calculate the restore performance,

wherein the performance management table includes for each volume at least a Redundant Array of Inexpensive Disks (RAID) configuration which constitute said volume, information indicating a read performance of said volume, and information indicating a write performance of said volume, and

wherein the restore performance is calculated based on at least the RAID configuration, read performance and write performance of each volume.

2. (Original) The storage system as claimed in Claim 1, wherein full backup, differential backup, or incremental backup is selected as the backup method.

3. (Original) The storage system as claimed in Claim 2, wherein the recovery object time is specified on a setup screen provided by a backup setup program in a management console connected with the storage system.

4. (Original) The storage system as claimed in Claim 3, wherein the setup screen provided by the backup setup program has fields for entry of recovery point objects including time, hour, total size of changed blocks, and the number of generations and a recovery time object.

5. (Previously Presented) The storage system as claimed in Claim 2, wherein the restore performance is estimated based on a write performance or a read performance, whichever is lower.

6. (previously presented) The storage system as claimed in Claim 5, wherein under the backup control program:

an estimated restore time for incremental backup is calculated by dividing the cumulative total size of changed blocks after full backup by the estimated restore performance;

a decision is made as to whether the calculated estimated restore time is within the recovery object time; and

if it is within the recovery object time, a changed part of the original volume for backup is copied into the storage pool for backup data to acquire an incremental backup.

7. (Currently Amended) A storage system comprising:

a disk controller which has a CPU, a main memory, and an interface;
and

a disk device which has original volumes for backup and a storage pool for backup data,

wherein the main memory incorporates a differential management program which checks whether the original volumes for backup are updated or not, a pool management program which allocates a disk area for storage of backup data to the storage pool for backup data, a performance management program which manages the performance of each volume of the disk device, and a backup control program which issues an instruction to the differential management program, the pool management program, and the performance management program for total backup control,

wherein the backup control program selects a backup method by which recovery within a user-specified recovery object time is possible, according to a restore performance calculated by the performance management program and the total size of changed blocks after backup acquisition, as counted by the differential management program,

wherein ~~wherein~~ full backup, differential backup, or incremental backup is selected as the backup method,

wherein ~~wherein~~ the restore performance is estimated based on a write performance or a read performance, whichever is lower; and

wherein under the backup control program:

an estimated restore time for incremental backup is calculated by dividing the cumulative total size of changed blocks after full backup by the estimated restore performance,

a decision is made as to whether the calculated estimated restore time is within the recovery object time,

if it is not within the recovery object time, the pool management program reallocates an area required for differential backup according to the total size of changed blocks as a difference from full backup and recalculates the estimated restore time for differential backup, and

if the recalculated estimated restore time is within the object time, a changed part of the original volume for backup is copied into the allocated area in the storage pool for backup data to acquire a differential backup.

8. (Currently Amended) A storage system comprising:

a disk controller which has a CPU, a main memory, and an interface;
and

a disk device which has original volumes for backup and a storage pool
for backup data,

wherein the main memory incorporates a differential management
program which checks whether the original volumes for backup are updated
or not, a pool management program which allocates a disk area for storage of
backup data to the storage pool for backup data, a performance management
program which manages the performance of each volume of the disk device,
and a backup control program which issues an instruction to the differential
management program, the pool management program, and the performance
management program for total backup control,

wherein the backup control program selects a backup method by which
recovery within a user-specified recovery object time is possible, according to
a restore performance calculated by the performance management program
and the total size of changed blocks after backup acquisition, as counted by
the differential management program,

wherein full backup, differential backup, or incremental backup is
selected as the backup method,

wherein the restore performance is estimated based on a write
performance or a read performance, whichever is lower, and

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wherein under the backup control program:

an estimated restore time for incremental backup is calculated by dividing the total size of changed blocks after full backup by the estimated restore performance,

a decision is made as to whether the calculated estimated restore time is within the recovery object time or not,

if it is not within the recovery object time, the pool management program reallocates an area required for differential backup according to the total size of changed blocks as a difference from full backup and recalculates the estimated restore time for differential backup, and

if the recalculated estimated restore time is within the object time, a full backup is made.

9. (previously presented) A storage system comprising:

a disk controller which has a CPU, a main memory, and an interface;

and

a disk device which has original volumes for backup,

wherein the storage system is connected through a data transfer line with a backup storage system which has a volume for storage of backup as a backup destination,

wherein the main memory incorporates a differential management program which checks whether the original volumes for backup are updated or not, a performance management program which manages the performance of each volume of the disk device, a data transfer program which transfers data between the storage system and the backup storage system, a backup destination management program which manages the backup volume for

backup data, and a backup control program which issues an instruction to the differential management program, the performance management program, the data transfer program, and the backup destination management program for total backup control,

wherein the backup control program selects a backup method by which recovery within a user-specified recovery object time is possible, according to a restore performance calculated by the performance management program and the total size of changed blocks after backup acquisition, as counted by the differential management program,

wherein the performance management program maintains a performance management table which is used to manage disk and volume performance and calculate the restore performance,

wherein the performance management table includes for each volume at least a Redundant Array of Inexpensive Disks (RAID) configuration which constitute said volume, information indicating a read performance of said volume, and information indicating a write performance of said volume, and

wherein the restore performance is calculated based on at least the RAID configuration, read performance and write performance of each volume.

10. (Original) The storage system as claimed in Claim 9, wherein full backup, differential backup, or incremental backup is selected as the backup method.

11. (Original) The storage system as claimed in Claim 10, wherein the recovery object time is specified on a setup screen provided by a backup setup program in a management console connected with the storage system.

12. (Original) The storage system as claimed in Claim 11, wherein the setup screen provided by the backup setup program has fields for entry of recovery point objects including time, hour, total size of changed blocks, and the number of generations and a recovery time object.

13. (previously presented) The storage system as claimed in Claim 10, wherein the restore performance is estimated based on a write performance or a read performance, whichever is lower.

14. (Original) The storage system as claimed in Claim 10, wherein the backup destination management program receives a storage volume for backup data from the volume management program in the backup storage system and determines where to store backup data.

15. (previously presented) A storage system comprising:
a disk controller which has a CPU, a main memory, and an interface;
and
a disk device which has original volumes for backup;
wherein the storage system is connected through a data transfer line with a backup storage system which has a storage volume for backup data as a backup destination,

wherein the storage system is connected with a backup server which has backup software to manage backup data on a file-by-file basis and a backup setup program,

wherein the main memory incorporates a differential management program which checks whether the original volumes for backup are updated or not, a performance management program which manages the performance of each volume of the disk device, a data transfer program which transfers data between the storage system and the backup storage system, a backup destination management program which manages the storage volume for backup data, and a backup control program which issues an instruction to the differential management program, the performance management program, the data transfer program, and the backup destination management program for total backup control,

wherein the backup control program selects a backup method by which it is possible to recover data within a recovery object time specified on a setup screen under the backup setup program of the backup server, according to a restore performance calculated by the performance management program and the total size of changed blocks after backup acquisition as counted by the differential management program

wherein the performance management program maintains a performance management table which is used to manage disk and volume performance and calculate the restore performance,

wherein the performance management table includes for each volume at least a Redundant Array of Inexpensive Disks (RAID) configuration which

constitute said volume, information indicating a read performance of said volume, and information indicating a write performance of said volume, and wherein the restore performance is calculated based on at least the RAID configuration, read performance and write performance of each volume.

16. (Original) The storage system as claimed in Claim 15, wherein full backup, differential backup, or incremental backup is selected as the backup method.

17. (Original) The storage system as claimed in Claim 15, wherein the setup screen provided by the backup setup program has fields for entry of recovery point objects including time, hour, total size of changed blocks, and the number of generations and a recovery time object.

18. (previously presented) The storage system as claimed in Claim 16, wherein the restore performance is estimated based on a write performance or a read performance, whichever is lower.

19. (previously presented) A backup method for a storage system which comprises a disk controller which has a CPU, a main memory, and an interface, and a disk device which has original volumes for backup and a storage pool for backup data, wherein the main memory incorporates a differential management program which checks whether the original volumes for backup are updated or not, a pool management program which allocates a disk area for storage of backup data to the storage pool for backup data, a

performance management program which manages the performance of each volume of the disk device, and a backup control program which issues an instruction to the differential management program, the pool management program, and the performance management program for total backup control,

the method comprising the steps of:

the differential management program counting the total size of changed blocks after a previous backup acquisition;

the performance management program calculating estimated restore time for backup by reading a write performance and a read performance and taking the lower performance as an estimated restore performance and dividing the total size of changed blocks by the estimated restore performance;

deciding whether the calculated estimated restore time is within a user-specified recovery object time or not; and

selecting a backup method by which recovery within the object time is possible,

wherein the performance management program maintains a performance management table which is used to manage disk and volume performance and calculate the restore performance,

wherein the performance management table includes for each volume at least a Redundant Array of Inexpensive Disks (RAID) configuration which constitute said volume, information indicating a read performance of said volume, and information indicating a write performance of said volume, and

wherein the restore performance is calculated based on at least the RAID configuration, read performance and write performance of each volume.

20. (Original) The backup method as claimed in Claim 19, wherein full backup, differential backup, or incremental backup is selected as the backup method.

21. (previously presented) The backup method as claimed in Claim 20, wherein a recovery object time is specified on a setup screen provided by a backup setup program in a management console connected with the storage system.

Claim 22 (canceled).